AI-Powered Clinic Management System

Technical & Functional Documentation

1. Introduction

This document describes an end-to-end AI-powered clinic management system designed for secure, reliable, and scalable appointment booking in the healthcare domain. The system connects conversational AI with a strict, database-driven backend to ensure data integrity, patient security, and business rule enforcement.

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2. Technology Stack

- **Frontend (Patient Portal):** Next.js
- **Admin Dashboard:** Next.js (Hosted on Vercel)
- **Backend Workflow Engine:** n8n (Hosted on AWS)
- **Database:** Supabase (PostgreSQL)
- **AI Layer:** Conversational AI integrated via n8n
- **Email & Notifications**: Workflow-based integration

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3. System Components

- **Patient Portal:** A clean and modern interface where patients interact with the AI assistant to book appointments.
- **Admin Dashboard:** A secure portal for clinic staff to manage doctors, appointments, schedules, and notes.
- **Logic Engine (n8n):** Orchestrates all backend workflows including validation, availability checks, booking logic, and notifications.

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4. AI Assistant Capabilities

1. Patient identity verification using registered email.
2. Real-time doctor availability checks.
3. Business hours enforcement (weekdays only, fixed time range).
4. Appointment booking with confirmation.
5. Booking limit enforcement (maximum 5 active appointments per patient).
6. Clear error handling and user guidance.

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5. Security & Validation

Security is enforced at multiple levels. Only registered patients are allowed to book appointments; unregistered users are blocked immediately. All booking rules are validated at the workflow and database levels.

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6. Data Integrity & Constraints

To prevent double bookings, a unique database index is implemented on doctor, date, and time. This makes it physically impossible to book the same slot twice. All bookings are transactional and consistent.

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7. Admin Dashboard Controls

1. View all appointments in real-time.
2. Edit appointment time and details.
3. Add internal notes for staff.
4. Restrict delete and cancel actions to authorized users only.
5. Maintain full human-in-the-loop control.

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8. System Architecture

The system uses a modular workflow architecture. A main orchestrator workflow manages the conversation state and delegates tasks to specialized worker workflows.

- **Main Orchestrator Flow:** Controls conversation logic.
- **Patient Check Worker:** Validates patient identity.
- **Availability Worker:** Checks doctor schedules and hours.
- **Booking Worker:** Confirms and saves appointments.
- **User Appointments Worker:** Displays patient bookings.

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9. Key Benefits

1. Enterprise-grade reliability.
2. Strict data integrity.
3. Secure and compliant booking flow.
4. Scalable and maintainable architecture.
5. Clear separation of AI and business logic.

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10. Conclusion

This AI-powered clinic management system demonstrates how conversational AI can be safely integrated into real-world healthcare workflows. By combining strict database rules, modular workflows, and human oversight, the system delivers both automation and trust.